this amount about 30,000 acres have actually been irrigated. The largest canals in operation are those of the Deschutes Irrigation and Power Company which divert water from the right bank of Deschutes River, a short distance above Bend. These canals have a common headgate, and are known as the Pilot Butte and Central Oregon canals. The maximum combined discharge of these two diversions has been about 600 second-feet. A number of other segregations have been made for reclamation under the terms of the Carey Act, and some ditches have been constructed and are in operation. The Columbia Southern Irrigating Company diverts water from Tumalo Creek: about 27,000 acres were segregated, but the water supply is insufficient for this entire area, although with the development of such storage facilities as the area affords they can doubtless all be irrigated from this stream.

FLOOD IN THE WILLAMETTE VALLEY IN FEBRUARY AND MARCH, 1910.

By H. J. ANDREE, Assistant Observer, Portland, Oreg.

This flood was caused by very heavy precipitation during the days immediately preceding the rise and the melting of snow on the western slopes of the Cascade Mountains, also in the lower portions of the river, by the high stage of the Columbia which was more than 9.0 feet above the normal during this time.

The Willamette, at Portland, was not at a low stage at any time during the month of March and averaged over 4.0 feet higher than during any March in the past 20 years. The stage of 19.6 feet on the 5th was higher than any recorded in March since the keeping of an official record.

The heaviest rains began on February 23 and continued through to March 4, with little interruption. During that time 18.0 inches fell along the northwest coast, about 5.0 inches in the Willamette Valley proper, and from 6.0 to 10.0 inches on the western slope of the Cascade Mountains. With the exception of that on the western side of the Coast Range, practically all the run-off flowed into the Willamette causing a rapid rise late in February and reaching the highest stage, 3.0 feet above flood stage, at Eugene on March 1, and 4.6 feet above the flood stage at Portland on the 5th. Besides the water from rains, there was more snow than usual at that time of year on the western slope of the Cascades and a large portion of it melted and added its volume to the already large amount in the Willamette Valley.

The water from these rains and melting snows flowed rather evenly into the main stream over its entire length and as a result there was no particular crest. Near the end of the month there was a second period of comparatively high water, due to more than the usual amount of precipitation from the 16th to the 23d, and the gage reading was 14.8 feet at 8:00 a. m. on the 26th at Portland. A few days after the second rise the river fell to below the normal stage at all stations except Portland, where, on account of the abnormal stage of the Columbia, the Willamette remained nearly 4.0 feet above the normal at the end of the month.

The loss caused by the flood was not great. As usual, the bottom lands were flooded. At Portland, where much damage would have been occasioned to property in warehouses and basements, those interested were notified of all stages long enough in advance to enable them to remove perishable goods.

The swift currents that frequently cause heavy losses to lumbermen and interfere with shipping near Portland, did not exist during this rise as they were checked by high water in the Columbia whose confluence with the Willamette is only a few miles below.

Warnings were issued regularly from the time of the beginning of the rise until the water had fallen to below the flood stage. The highest stage at Salem was predicted within 0.2 foot 24 hours in advance, and the crest at all stations was predicted to within a few tenths of the stage actually reached. The exception was at Portland where the forecast was 0.9 foot too low; this low forecast was due to the existence of conditions not previously experienced here, namely high water in the Columbia at the time of a spring freshet in the Willamette, and it was practically impossible to accurately estimate the stage resulting from the unusual conditions, so close to the confluence of the streams. So far as is known, no losses occurred on account of this forecast as all those having only about a foot margin were advised to move valuable goods.

Warnings were also issued for the second rise at Portland. On Wednesday, March 23, a bulletin was published on the daily weather map to the effect that the river would reach 15.0 feet at Portland on Saturday the 26th. At 8 a. m. of the 26th the gage reading was 14.8 and the river was still rising, but had begun to fall before evening.

The accompanying tables show the stages of the water at the several gaging stations and the dates and maximum stages of other floods.

Daily stages in the Willamette River freshet of February 27 to March 9, 1910, inclusive.

Date.	Eugene.	Harrisburg.	Albany.	Salem.	Wilsonville.	Portland.	Jefferson.	McMinnville.	Tualitan.	Estacada.
	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
February 27 a. m.	7.8	5.9	12.4	12.5	21.8	10.7	6.7	26.2	.....	7.8
February 28 a. m.	8.6	6.4	12.4	12.5	22.4	11.5	8.0	27.0	.....	10.0
March 1, a. m.	11.7	8.3	13.8	14.4	22.6	12.4	10.6	28.0	.....	12.0
March 1, p. m.	13.0	10.2	14.8	15.3	23.1	13.5	13.6	28.1	.....	14.4
March 2, a. m.	12.0	10.3	16.6	18.1	24.6	15.3	15.0	28.0	11.4	14.5
March 2, p. m.	10.6	10.0	18.0	19.5	25.3	16.3	14.0	28.1	11.8	13.7
March 3, a. m.	10.0	9.2	20.0	20.8	27.6	17.5	11.9	27.3	12.3	12.6
March 3, p. m.	.....	8.8	20.0	20.7	27.9	18.0	10.6	26.9	12.5	11.9
March 4, a. m.	9.2	8.0	18.3	19.6	28.6	18.7	9.0	25.3	12.8	11.0
March 5, a. m.	8.2	7.2	16.0	16.3	24.0	19.6	8.0	21.4	.....	10.0
March 6, a. m.	7.6	6.5	12.7	13.1	22.2	19.3	7.0	16.4	.....	9.0
March 7, a. m.	7.2	5.8	10.0	11.0	20.4	18.1	6.0	12.8	.....	8.2
March 8, a. m.	6.6	5.1	9.4	9.2	19.0	16.1	5.4	10.7	.....	7.7
March 9, a. m.	6.4	4.5	8.4	8.0	15.1	14.2	5.4	9.1	.....	7.5

Stages reached in 29 Willamette River freshets at Portland, Oreg.

Year.	Date.	Stage.	Year.	Date.	Stage.
		Feet.			Feet.
1880..	January 9	15.8	1896..	December 15	15.2
1881..	January 16	21.4	1897..	December 14	15.1
1881..	February 7	23.6	1899..	January 22	14.2
1883..	February 3	16.6	1899..	December 2	15.0
1885..	January 9	15.8	1900..	January 17	16.7
1886..	February 4	17.1	1901..	January 17	20.9
1887..	February 1	15.8	1901..	February 19	14.7
1888..	February 1	16.6	1903..	January 28	19.2
1890..	February 6	28.4	1907..	January 3	14.9
1893..	December 4	18.7	1907..	February 8	22.5
1894..	January 18	19.5	1907..	December 28	17.3
1894..	March 19	18.0	1909..	January 22	20.5
1895..	January 14	15.9	1909..	November 26	22.3
1896..	January 23	20.5	1910..	March 5	19.6
1896..	November 19	20.2			

Figs. 1 and 2 show the distribution of the rainfall producing the flood and the stages of the river at several points in its course.

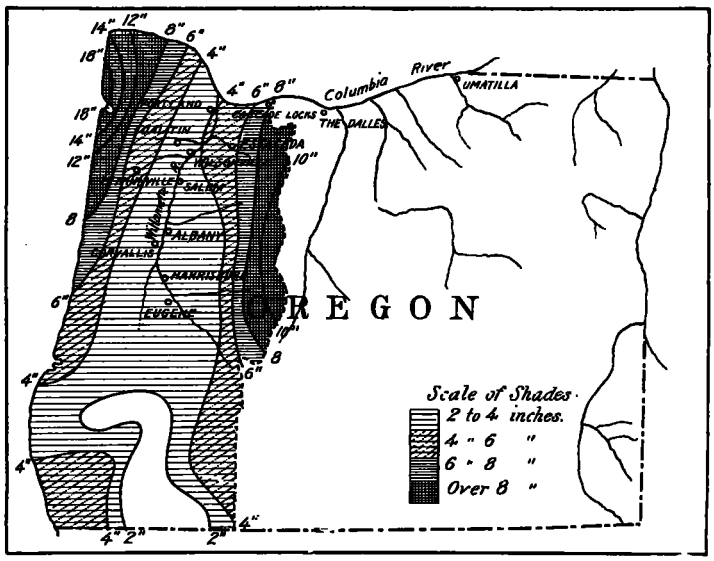

FIG. 1.—Precipitation in western Oregon from February 23 to March 7, 1910, inclusive.

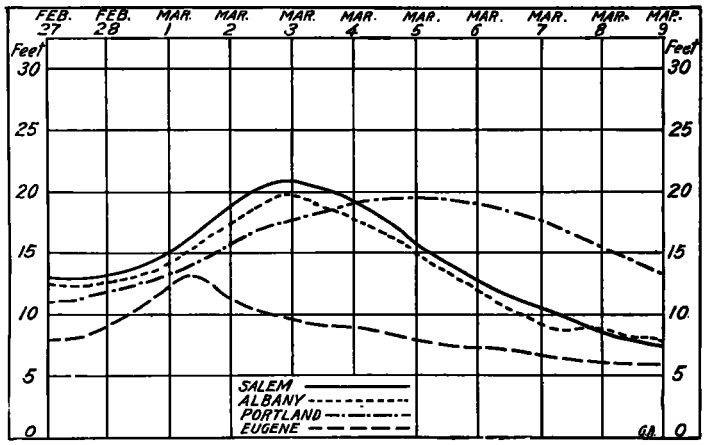

FIG. 2.—River stages, Willamette River, February 27 to March 9, 1910, inclusive.